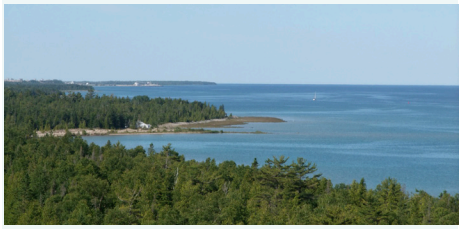
Great Lakes Restoration Initiative

Foreasting Beach Water Quality to Improve Human & Coastal Health

Nearshore Pollution in the Great Lakes

With over 10,000 miles of coastline, the Great Lakes draw tens of millions of beach-goers each year. The region's beaches and nearshore areas are vulnerable, however. Excessive nutrient loading, agricultural and stormwater runoff, industrial pollution, and wildlife waste all degrade nearshore water quality. Bacteria and other pathogens can threaten both human well-being and Great Lakes ecosystem health. For this reason, the GLRI Action Plan identified nearshore health and nonpoint source pollution as one of five issues requiring urgent attention.



NOAA's Role in Improving Great Lakes Human and Coastal Health

NOAA's Center of Excellence for Great Lakes and Human Health (CEGLHH) was created in 2004 to advance understanding of Great Lakes ecosystem processes and, in doing so, promote natural resource decision-making to reduce human health risks. With GLRI support, the Center is working to improve technologies to identify and forecast the presence of two contaminants in the Great Lakes: *E. coli* and Harmful Algal Blooms (HABs).

Recognizing the importance of the Great Lakes to our nation, President Obama made restoration a national priority. The resulting Great Lakes Restoration Initiative (GLRI) is the largest investment in the Great Lakes in two decades. The GLRI Action Plan identifies five issues requiring urgent action: Toxics and Areas of Concern; Invasive Species; Nearshore Health and Nonpoint Source Pollution; Habitat and Wildlife Protection and Restoration; and Monitoring, Communication, and Partnerships. A task force of 16 federal agencies has been charged with implementing initiatives to address these focus areas over a five-year period (FY 2010-2014).

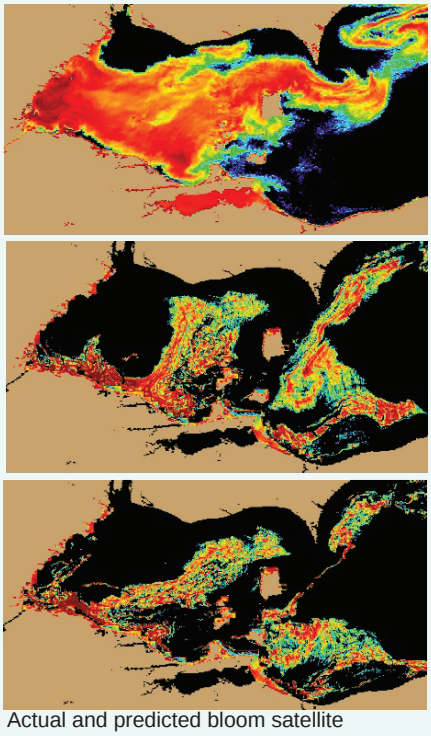
The Problem: *Degraded nearshore water quality*

Great Lakes beaches, an important recreational asset of the region, are occasionally closed due to degraded water quality conditions caused by elevated *E. coli* concentrations or the presence of toxic algae. Monitoring for beach water quality, including *E. coli* concentrations, is intended to reduce public health risks, as infection with the bacteria may pose adverse health impacts such as flu-like symptoms or gastroenteritis. Development of decision support tools that can forecast beach water quality conditions enable environmental and public health officials to notify the public of expected water quality one to two days in advance, thereby helping to close beaches when necessary but preventing beach closures when conditions are safe and avoiding negative local economic impacts.

Algae are commonly part of a healthy ecosystem, but blue-green algae produce toxins that can harm both humans and aquatic life. These toxic algae are referred to as Harmful Algal Blooms (HABs). *Microcystis*, the most common blue-green algae in the Great Lakes, produces the toxin Microcystin. This toxin may cause liver damage, skin irritation, and flu-like symptoms in humans. "Loading" of soluble reactive phosphorus (from sources such as agricultural fertilizer, sewage treatment plants, and industrial runoff) into lake watersheds contributes to these blooms. While Lake Erie's Western Basin is best known for HABs, blooms also occur in western Lake Michigan, Lake Michigan's Green Bay, and Lake Huron's Saginaw Bay, as well as some inland tributaries.

Current methods of measuring *E. coli* concentrations and HABs toxins are expensive and require specialized training; they also carry a time lag between collecting cells and obtaining results. More timely and less expensive methods of identifying and forecasting HABs toxins and *E. Coli* could better protect human and ecosystem health without placing undue burdens on public health officials in coastal communities.

Experimental
Lake Erie Harmful Algal Bloom Bulletin



Actual and predicted bloom satellite imagery for western Lake Erie, depicting intensity, size, and movement of bloom. (top) actual image (middle) nowcast predicted, (bottom) 48 hour forecast.

MODIS satellite image of Lake Erie bloom, October 6, 2011.

The Response: *Better forecasting, better outcomes*

NOAA is now in the process of evaluating and improving models to accurately and rapidly forecast *E. coli* levels in nearshore waters—ensuring that decision makers have appropriate information to avoid closing beaches unnecessarily. We are working closely with the beach managers, state parks, and county health departments who carry ultimate responsibility for issuing advisories on beach water quality, and preliminary results are very promising.

With GLRI support, CEGLHH scientists collected data through field sampling and remote sensing. Data are used to improve identification and understanding of environmental factors that contribute to *E. coli* levels and the development and growth of HABs. The data are also used to create, often in collaboration with other experts, tools and technologies for improved decision support tools of these contaminants. More timely predictions of *E. coli* levels and HAB size and location increase options for managing their impacts on human, wildlife, and ecosystem health.

NOAA has also developed an experimental HAB bulletin that provides a weekly forecast for *Microcystis* blooms in western Lake Erie. When a harmful bloom is detected by the experimental decision support system, scientists issue a bulletin that reports HABs current location, forecasts its future movement, and categorizes its intensity. Current and archived bulletins are available online, allowing decision-makers, coastal community residents, and visitors alike to better monitor and plan around the presence of HABs.

NOAA will continue to evaluate and improve these early predictive models for *E. coli* and HABs, all with the objective of enhancing our understanding of these Great Lakes challenges and reducing their impact.

Project Partners

- Cooperative Institute for Limnology and Ecosystems Research (CILER)
- Bay County, Ottawa County, and Macomb County Health Departments
- Michigan Sea Grant
- Palm Island EnviroInformatics
- Robert B. Annis Water Resources Institute (AWRI) at Grand Valley State University
- National Oceanic and Atmospheric Administration, National Ocean Service
- National Weather Service Forecast Office in White Lake, Michigan (WFO DTX)
- Environmental Protection Agency (EPA)

GLRI Project Funding: A year-by-year breakdown

FY 2010: $2,000,000 FY 2011: $1,000,000 FY 2012: $836,000

For More information

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